Percutaneous Intravertebral Body Embolization of a Traumatic Spinal Epidural Arteriovenous Fistula with Secondary Perimedullary Venous Reflux

A Case Report

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Summary

Arteriovenous fistulas following vertebral fractures are probably very rare. We present a case with fistulous connection between arteries and veins within the fractured 12th thoracic vertebral body with retrograde venous drainage to perimedullary veins resulting in spinal venous hypertension and a cauda equina like symptomatology.

Pre-treatment 3D CT enabled us to puncture the venous pouch within the vertebra and deposit glue in the vertebral fistula. The procedure led to a complete occlusion of the fistula and relief of pain and neurological symptoms.

Introduction

Spinal dural arteriovenous fistulas (SDAVF) and epidural arteriovenous fistulas (EDAVF) are relatively frequently reported in the literature [1,2]. Endovascular treatment seems to be the most common treatment strategy [3-5]. SDAVF and EDAVF may give rise to intradural venous hypertension and venous congestion. The increase in venous pressure because of the fistula leads to decreased drainage of normal spinal veins [2].

EDAVF related to vertebral body fracture was previously reported only once before in the literature by Silva Jr et Al [6]. To our knowledge, percutaneous, intravertebral embolization by coaxial technique in an intravertebral AVF with retrograde intradural venous drainage has not been reported in the literature to date. This type of spinal AVF has not yet been included in common classifications of spinal AVFs [2,7-10]. Although this fistula type is not described specifically in any classification of spinal AV fistulas it might best fit it into the new classification system by Lasjaunias and Geibprasert as the "ventral group" of epidural fistulas [8]. We present such a case with signs and symptoms of intradural venous hypertension following a fracture of the 12th thoracic vertebra.

Case Report

A 67-year-old hypertensive man with a history of compression fracture of the 12th thoracic vertebra (several years ago) presented with slowly progressive bilateral lower extremity sensory disturbances, gait ataxia, urinary bladder dysfunction, back pain and radicular pain. MRI demonstrated a healed fracture in Th 12 and dilated perimedullary veins and myelopathy (Figure 1).

4DMRA and CT-angiography raised the suspicion of a fistula within the vertebral body because the right-sided part of an intravertebral channel enhanced after contrast medium injection (Figure 2A,B). The filling of a vessel-like

Figure 1 A) Sagittal T2-weighted MRI shows a healed wedge fracture in Th12 (asterix), dilated basivertebral vein (arrow) and dilated perimedullary veins (arrowheads) as well as spinal cord hyperintensity. B) Coronal MRA frontal thin slice MIP shows dilated intradural veins (arrow).

intravertebral structure was verified by selective angiography through three intercostal arteries (Figure 3A,B). Multiple small osseous arteries filled the venous pouch that emptied into the basivertebral vein. We could not reach the fistula through the arterial approach because of the multiple small intravertebral feeders. Coiling of the right pedicular artery was unsuccessful in closing the fistula but led to partial symptom reduction.

Using a percutanous transpedicular "vertebroplasty-like" approach, a 13 G bone biopsy needle was inserted and the venous channel inside the vertebra was targeted. Then a 22 G Chiba needle was curved at the tip with a pair of pliers and introduced through the biopsy

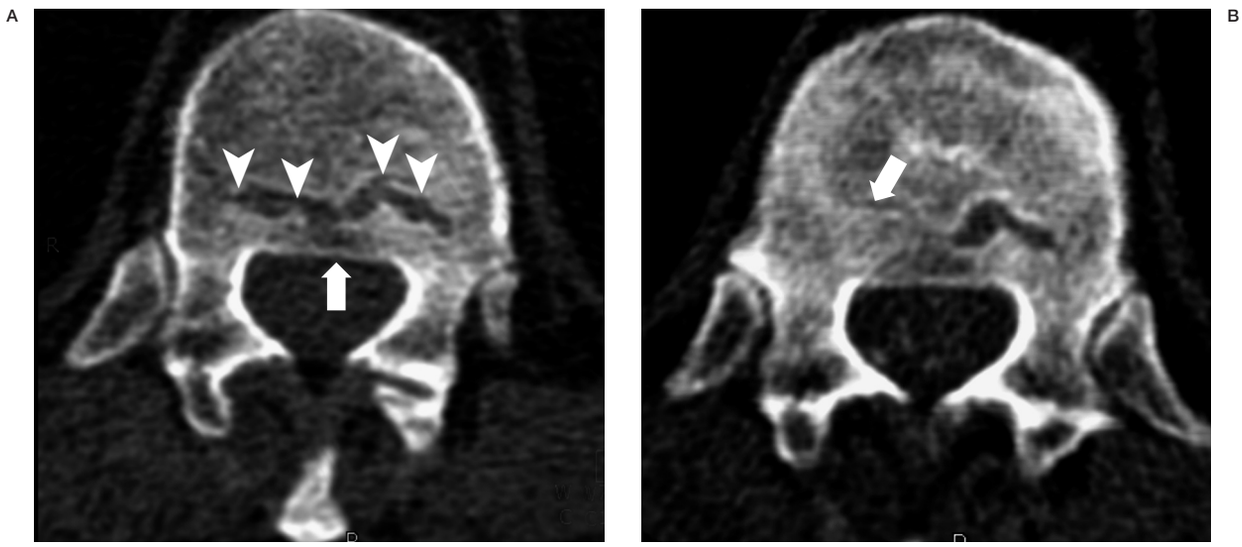

Figure 2 A) Axial non-contrast CT image shows a channel inside the posterior part of TH 12 (arrowheads) converging towards the basivertebral vein (arrow). B) Axial contrast enhanced CT shows that the right part of the channel is filled with contrast (arrow) and there are dilated intraspinal veins.

needle after which the tip of the needle was oriented toward the basivertebral vein (Figure 3C). Intraosseous venography through the transpedicular needle showed the osteoepidural fistula and its retrograde intradural venous drainage (Figure 3D).

0.5 cc Histoacryl glue (N-butyl-2-cyanoacrylate; B. Braun Melsungen AG Carl-Braun-Straße 1 34212 Melsungen, Germany) mixed with 0.5 cc Lipiodol Ultra Fluid (Guerbet BP 57400 95943 Roissy CdG Cedex, France) was injected at the intraosseous fistula site through the 22 G Chiba needle. Angiography was performed through the 13 G biopsy needle demonstrating a complete occlusion of the AVF as well as the basivertebral vein (Figure 3F).

CT control showed exact deposition of the glue (Figure 4) in the previously enhancing vascular channel of the vertebra, the basivertebral vein and its connection to the epidural vein. Control 4D MRA showed complete occlusion of the fistula system (Figure 5A) and MRI showed normalisation of the previously observed pathological medullary signal (Figure 5B).

The patient improved immediately from his symptoms related to intradural venous hypertension. He experienced normalization of urinary bladder function and was able to walk independently within five weeks (he was barely able to walk with support before emoblization of the fistula). His back pain and radicular pain resolved almost immediately after the procedure.

Discussion

This case represents the only known therapeutic percutaneous intraosseous embolization in a patient with a post-traumatic intravertebral AVF with intradural reflux. A paper by Silva Jr et Al [6] reported a similar case. In their case, embolization with glue through a "T-12 artery" was successful. This is the only other post-traumatic case with an AVF known to us. However, they did not describe an intravertebral fistula although the images indicate that such a case was present. It might be that our case represents a novel type of EDAVF. It might even be that this condition, as well as other types of spinal AVFs, is overlooked in the vast materials of vertebral compression fractures [11].

The clinical differential diagnosis in SAVF is difficult and includes disk disease, tumour and polyneuropathy. In order to find and treat such cases it seems important to obtain high quality spinal CT examination of the fractured vertebra and compare examination before and after intravenous contrast medium injection.

The treatment might be successful with intrarterial embolization through the pedicular arteries of the spine. A venous route is an alternative treatment strategy but is often difficult [5].

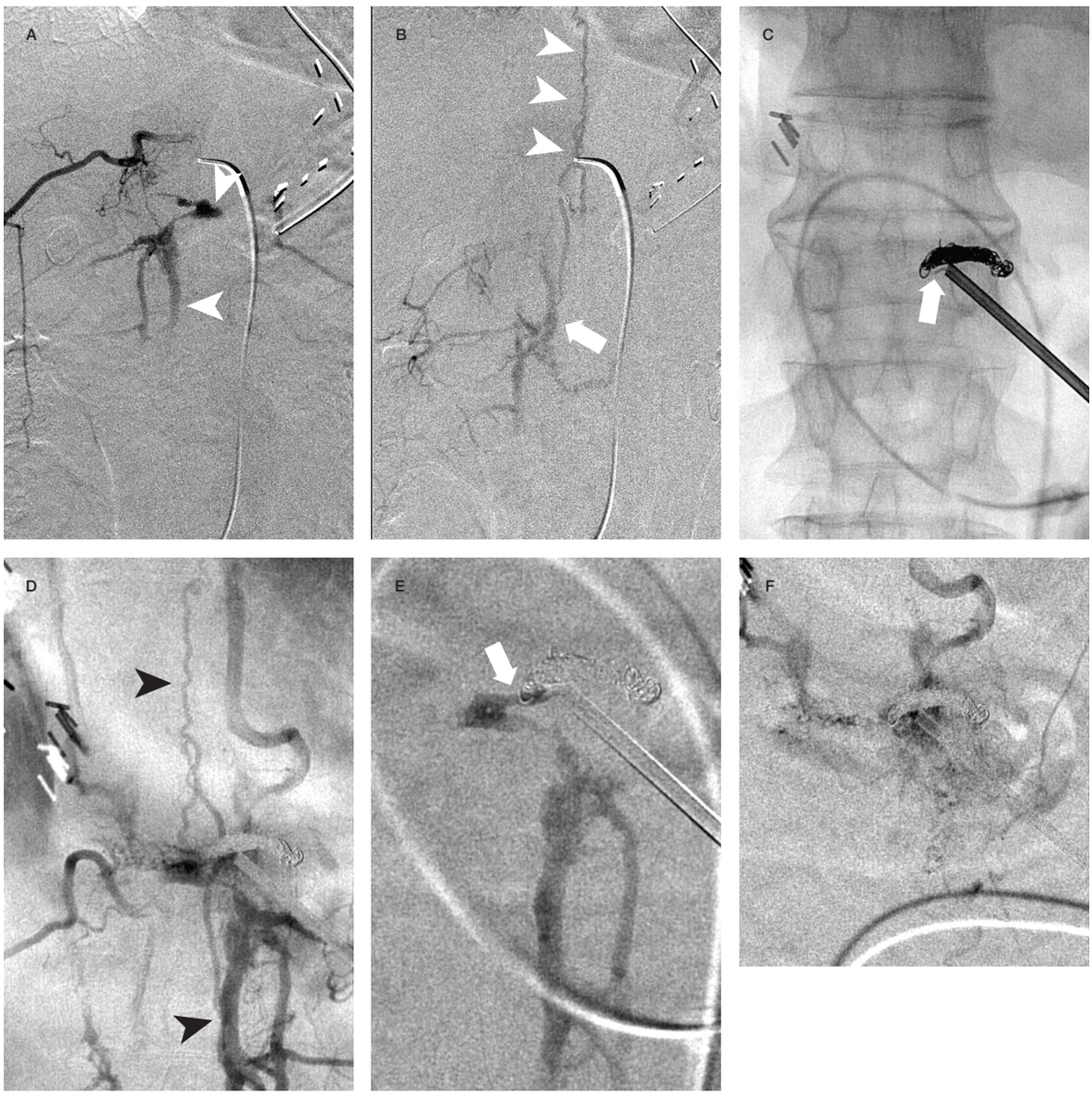

Figure 3 A) Early phase spinal DSA shows small osseous feeders through the bone to the basivertebral vein (arrowhead) and epidural veins (arrow). B) Late phase spinal DSA shows epidural to intradural reflux through a vein at the right L1 pedicle (arrow) and dilated perimedullary veins (arrowheads). C) Transpedicular needle position (posterior view) and the coaxially inserted Chiba needle (arrow) pointing medially. D) Intravertebral venography (posterior view) shows transpedicular needle (large arrow), the extradural to intradural connection (arrowhead) and the dilated perimedullary veins (small arrow). E) Intravertebral superselective injection through the 22 G coaxially inserted Chiba needle shows details of the intravertebral channel (arrow) and its epidural drainage through the basivertebral vein. F) Post embolization intravertebral venography through the introducer needle showing closure of the intraosseous venous part of the fistula.

Surgical clipping of the radicular vein that the shunt refluxes into is another but more invasive treatment option. This will reduce the intraspinal venous hypertension although the osteoepidural fistulae itself is not closed but may spontaneously trombose itself. In our case the easiest way to reach the "foot" of the vein was to puncture it directly through the vertebra. In cases where these procedures seem risky and technically difficult we suggest our percutaneous method as presented above. The method used in our case results from experience in

both super selective embolization and long time experience with vertebroplasty and preoperative 3D CT in planning before puncturing relatively small targets [12].

Conclusions

Interventional techniques have proved to be efficient in treatment of the relatively rare spinal arteriovenous fistulas. Our case demonstrates that such fistulas may develop within the vertebra after fracture and partly drain through a radicular vein and thus pass the dura into the medullary veins; this can result in increased spinal venous pressure and venous congestion.

An embolization technique based on a percutaneous, transpedicular approach and gluing of the intravertebral fistula has been shown to be an effective treatment alternative in such an extremely rare case.

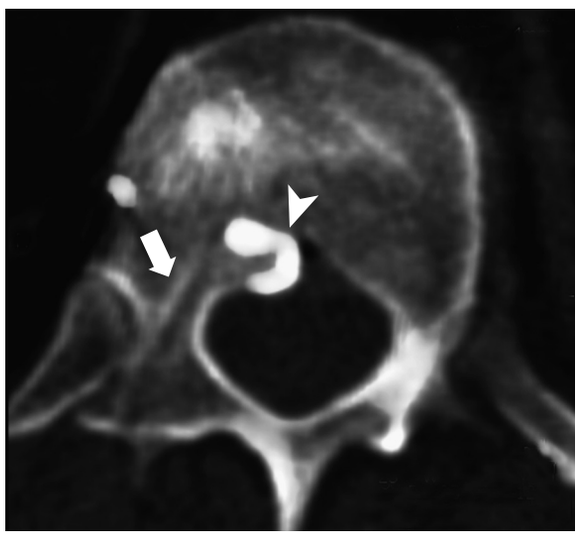

Figure 4 Post treatment axial CT shows glue cast in the right part of the intravertebral vascular channel and in the basivertebral vein (arrowhead) and the needle channel through the right pedicle (arrow).

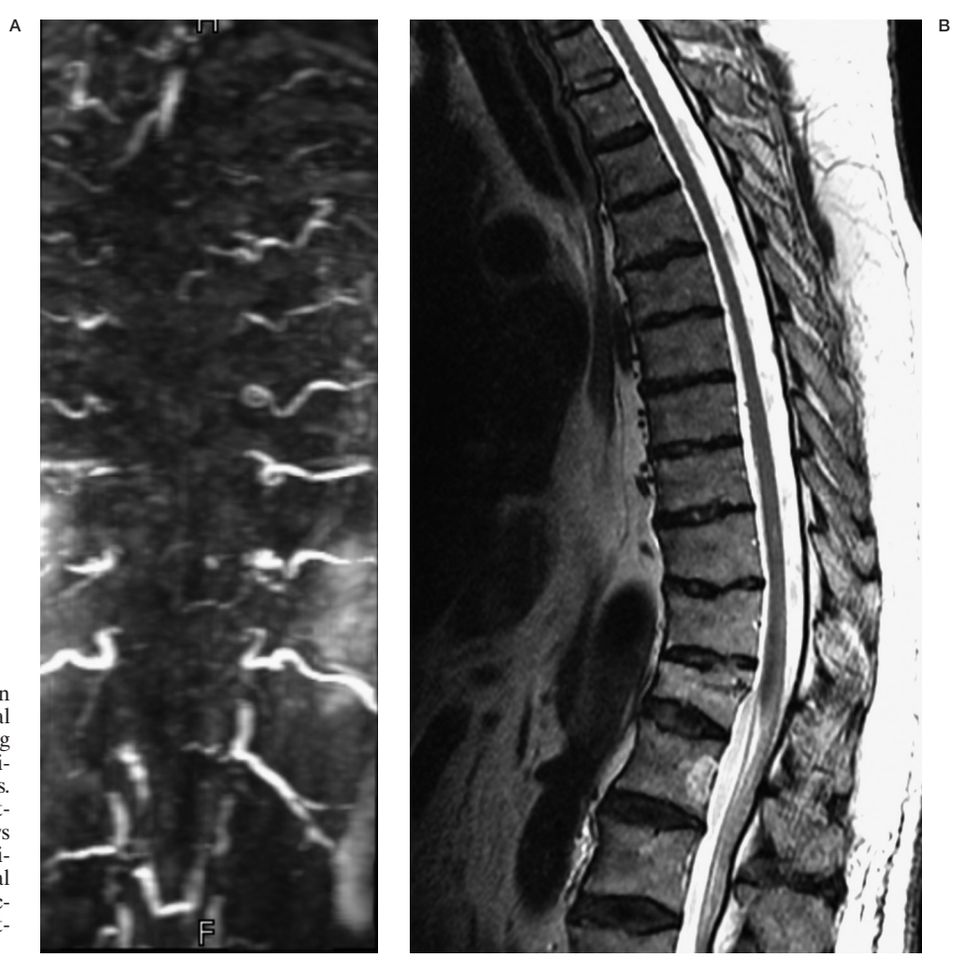

Figure 5 A) Coronal thin slice MIP of the spinal canal in arterial phase showing normal anatomy and no dilatation of intraspinal veins. B) Post embolization sagittal T2-weighted MRI shows normalisation of the previously observed pathological medullary signal and reduction of the previously dilated perimedullary veins.

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